ASPIDOBOTHREAN TREMATODES FROM OHIO MUSSELS[1]

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ABSTRACT

Three hundred and seventy-four mussels representing 37 species of the family Unionidae were collected from streams in the Ohio River and Lake Erie drainages in Ohio during 1966. Mussels were examined for aspidobothrean trematodes only. Two species, *Aspidogaster conchicola* von Baer, 1827, and *Cotylaspis insignis* Leidy, 1857, were recovered and are reported for the first time from Ohio. *Aspidogaster* was much more abundant than *Cotylaspis*. The difference in abundance is interpreted to be due to greater host specificity on the part of *Cotylaspis* in Ohio (a relationship that is apparently not universal).

INTRODUCTION

The Aspidobothrea are believed to be a distinct subclass of the Class Trematoda (Faust and Tang, 1936). They are characterized by a large, ventral, discoidal, adhesive organ which is divided into alveoli, and are parasitic in mollusks and poilkilothermous vertebrates. (A more complete description of the subclass is found in Dollfus, 1958).

In North America, only three genera of aspidobothreans have been reported from mussels. These are *Cotylogaster* Monticelli, 1892, *Cotylaspis* Leidy, 1857, and *Aspidogaster* von Baer, 1827. The genus *Cotylogaster* contains three species, but only *C. occidentalis* Nickerson, 1902, has been reported from North American mussels (in Iowa—Kelly, 1899). The other two species of *Cotylogaster* are parasitic in the intestines of teleostean fishes. There are nine species of *Aspidogaster*. With the exception of *A. conchicola* von Baer, 1827, *A. antipai* Lepsi, 1932, and *A.* sp. Hornell, 1904, all species of *Aspidogaster* are parasites of freshwater fishes. *Aspidogaster conchicola* is the only species reported from North American mussels. It has been reported in the United States in Pennsylvania (Leidy, 1857; Kelly, 1899); Iowa (Kelly, 1899); Illinois (Kelly, 1899; Williams, 1942; Van Cleave and Williams, 1943); Florida, Alabama, and Georgia (Hendrix and Short, 1965); Texas (Gentner and Hopkins, 1966); and Washington (Pauley and Becker, 1968).

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The genus *Cotylaspis* contains five species. All members of this genus except *C. insignis* Leidy, 1857, are intestinal parasites of turtles and fishes. Najarian (1961) described *C. reelfootensis*, which was later reduced to synonymy with *C. insignis* by Hendrix and Short (1965). *Cotylaspis insignis* is the only species recorded from North American mussels. It has been reported in the United States from Pennsylvania, Illinois and Iowa (Kelly, 1899); Michigan (Stunkard, 1917); New York (Osborn, 1903); Tennessee (Najarian, 1961); Florida, Alabama, and Georgia (Hendrix and Short, 1965); and Texas (Gentner and Hopkins, 1966).

This study was undertaken to see which if any species of aspidobothreans could be found in the mussel fauna of Ohio and to report new hosts and new localities for these trematodes.

METHODS

During the summer of 1966 a study was made of the aspidobothrean trematodes parasitizing unionid mussels of Ohio. No other species of trematodes were considered in this study. A total of 374 mussels representing 37 species of 25 genera was collected by hand and by otter trawl from 17 localities (Table 6) in the Lake Erie and Ohio River drainages. Mussels were dissected, identified by shell characters, and deposited in the Ohio State Museum. Mussel tissue was shredded with needle-point dissectors, and worms were removed to Ringer's solution with pipettes. The tissue was then washed and shaken in Ringer's solution to remove any remaining worms. Aspidobothreans were heat-killed by boiling in Ringer's solution, fixed in A.F.A., stained with Semicon's carmine stain, cleared in xylene, and mounted on glass slides in piccolyte.

RESULTS

Aspidogaster conchicola and *Cotylaspis insignis* were found and are reported for the first time from Ohio. Although I have collected *Cotylogaster occidentalis* from the freshwater drum (*Aplodinotus grunniens*) in Lake Erie, it did not occur in any mussels in this investigation.

Aspidogaster was recovered from 89 of 374 mussels collected in Ohio (Table 4), from 23 of 37 species of mussels (Tables 1, 2, and 3). Of the 1109 specimens of *Aspidogaster* collected, 21 percent came from members of the subfamily Ambleminae, 55 percent came from members of the subfamily Lampsilinae, and 15 percent came from members of the subfamily Anodontinae. The amblemine mussels had the highest percentage of infestation (Table 1), with an average worm burden of 2.5 worms/mussel; the anodontines had the lowest worm burden (2.1 worms/mussel). Whereas only 17% of the Lampsilinae were infested, they had the greatest worm burden with 3.6 worms/mussel. High frequencies of infestation occurred in some members of all three subfamilies of mussels (Table 4). *Aspidogaster* occurred almost everywhere in Ohio where mussels were collected, but reached its greatest density in the lower Muskingum River in southeastern Ohio. Seventy-four mussels were dissected from Area 12. Of these, 23 (31%) were infested with a total of 611 worms (28 worms/mussel). Of 42 mussels collected upstream in the Walhonding River, at Area 9, seven were infested with a total of 35 *Aspidogaster* (5 worms/mussel).

Cotylaspis was not as abundant as *Aspidogaster*. Only nine of the 37 species of mussels carried this worm (Table 5). The total number of *Cotylaspis* collected was 382. Ninety-one percent of these were found in anodontine mussels, whereas the lampsilines contributed 8 percent and the ambelmines harbored less than 1 percent. Percentages of infestation are given in Tables 1, 2, and 3. *Cotylaspis* was not widely distributed among the three subfamilies. High frequencies of infestation occurred only in the genus *Anodonta*. The distribution of *Cotylaspis* in Ohio appears similar to that of *Anodonta*.

TABLE 1

Members of the Ambleminae infested with aspidobothreans

No.	Species	*Aspidogaster*	*Cotylaspis*
18	*Fusconaia flava*	1	0
2	*F. ebena*	0	0
1	*F. subrotunda*	0	0
40	*Amblema plicata*	11	1
11	*Quadrula quadrula*	9	0
6	*Q. metanevra*	0	0
13	*Q. pustulosa*	13	0
2	*Tritogonia verrucosa*	2	0
5	*Megalonaias gigantea*	0	0
3	*Cyclonaias tuberculata*	3	0
2	*Pleurobema coccineum*	1	0
2	*P. cordatum*	0	0
1	*P. clava*	0	0
10	*Elliptio crassidens*	0	0
11	*E. dilatatus*	2	0
127		42 (33%)	1 (0.8%)

TABLE 2

Members of the Anodontinae infested with aspidobothreans

No.	Species	*Aspidogaster*	*Cotylaspis*
1	*Lasmigona compressa*	0	0
31	*L. costata*	1	0
22	*Anodonta grandis*	17	18
2	*A. imbecillus*	1	1
2	*A. marginata*	0	0
11	*Alasmidonta marginata*	1	0
8	*Strophitus undulatus*	0	3
77		20 (26%)	22 (28%)

TABLE 3

Members of the Lampsilinae infested with aspidobothreans

No.	Species	*Aspidogaster*	*Cotylaspis*
6	*Ptychobranchus fasciolaris*	1	0
16	*Obliquaria reflexa*	2	0
1	*Obovaria subrotunda*	0	0
39	*Actinonaias carinata*	0	0
3	*Truncilla donaciformis*	1	0
4	*Plagiola lineolata*	0	0
9	*Leptodea fragilis*	9	0
14	*Proptera alata*	7	0
4	*Carunculina parva*	0	2
7	*Ligumia recta*	1	0
4	*L. nasuta*	4	1
1	*Lampsilis fasciola*	1	0
44	*L. radiata siliquoidea*	1	8
16	*L. ovata ventricosa*	1	2
2	*Dysonomia triquetra*	1	0
170		29 (17%)	13 (7%)

TABLE 4
Unionid mussels infested with Aspidogaster conchicola

Mussel	Number collected	Number infested	Number worms	Worms/ mussel
Fusconaia	21	1	1	—
Amblema	40	11	64	1.6
Quadrula	30	22	219	7.3
Pleurobema	5	1	2	—
Tritogonia	2	2	19	9.5
Cyclonaias	3	3	18	6.0
Elliptio	21	2	5	—
Megalonaias	5	0	—	—
Lasmigona	32	1	1	—
Anodonta	26	17	120	4.6
Alasmidonta	11	1	45	4.1
Strophitus	8	0	0	—
Ptychobranchus	6	1	4	—
Obliquaria	17	2	2	—
Actinonaias	39	0	—	—
Truncilla	3	1	1	—
Plagiola	4	0	0	—
Leptodea	9	9	380	42.0
Carunculina	4	0	—	—
Proptera	14	7	202	14.4
Ligumia	11	5	21	1.9
Lampsilis	61	2	2	0.1
Dysnomia	2	1	3	1.5
	374	89	1109	3.0

TABLE 5
Unionid mussels infested with Cotylapsis insignis

Mussel	Number collected	Number infested	Number worms	Worms/ mussel
Fusconaia	21	0	—	—
Amblema	40	1	1	—
Quadrula	30	0	—	—
Pleurobema	5	0	—	—
Tritogonia	2	0	—	—
Cyclonaias	3	0	—	—
Elliptio	21	0	—	—
Megalonaias	5	0	—	—
Lasmigona	32	0	—	—
Anodonta	26	19	316	12.7
Alasmidonta	11	0	—	—
Strophitus	8	3	33	4.1
Ptychobranchus	6	0	—	—
Obliquaria	17	0	—	—
Actinonaias	39	0	—	—
Truncilla	3	0	—	—
Plagiola	4	0	—	—
Leptodea	9	0	—	—
Carunculina	4	2	7	1.7
Proptera	14	0	—	—
Ligumia	11	1	2	—
Lampsilis	61	10	23	—
Dysnomia	2	0	—	—
	374	36	382	1.0

TABLE 6
Localities of mussel collections[a]

Lake Erie Drainage:
Glaciated Till Plains:
Area 1. St. Joseph River at Hwy 34; Williams Co.
Area 2. St. Joseph River at Pioneer; Williams Co.
Area 3. Sandusky River at Upper Sandusky; Wyandot Co.
Area 4. Lake Erie off Kelly's Island; Erie Co.
Area 5. Lake Erie, Fisheries Bay; S. Bass Island; Ottawa Co.

Allegheny Plateau:
Area 6. Cuyahoga River at Hiram Rapids; Portage Co.
Area 7. Cuyahoga River, East Branch above res.; Geauga Co.
Area 8. Grand River at Painesville; Lake Co.

Ohio River Drainage:
Allegheny Plateau:
Area 9. Walhonding River at Hwy 36; Coshocton Co.
Area 10. Walhonding River at Coshocton; Coshocton Co.
Area 11. Muskingum River at Luke's Chute; Washington Co.
Area 12. Muskingum River below dam at Lowell; Washington Co.

Glaciated Till Plains:
Area 13. Olentangy River below dam at 5th Ave., Columbus; Franklin Co.
Area 14. Big Darby Creek below Fox; Pickaway Co.
Area 15. Stillwater River at Dog-leg Rd.; Montgomery Co.
Area 16. Big Miami River above Taylorville dam; Montgomery Co.
Area 17. Ohio River at Ripley; Brown Co.

[a]Numbers correspond to those in Figure 1.

DISCUSSION

It is apparent from the results that there is a great difference in abundance between the two species of aspidobothreans found in Ohio mussels. An answer to this problem might be sought in the ecology and host-parasite relationships of these trematodes. Host specificity has been related to zoogeographic distribution of parasites by Manter (1967). The lower the specificity of the parasite, the greater the chances of dispersal and therefore the wider its distribution. It has been suggested by Van Cleve and Williams (1943) that *Aspidogaster* has a low host specificity. Evidence for this is found in the large numbers of mussels it parasitizes. Its apparent wide distribution in Ohio would appear to be related to the fact that it parasitizes 23 species of mussels. Its apparent absence from certain areas of Ohio might be explained by the relatively small number of mussels collected in those places.

Cotylaspis on the other hand, appears to have a much higher host specificity. In a study done in Lake Chautauqua by Osborn (1903), *Cotylaspis* was recovered only from *Anodonta*, although a number of other species of mussels were collected. I recovered *Cotylaspis* from only nine of the 37 species of mussels collected in Ohio. *Anodonta* harbored more *Cotylaspis* more frequently than any other mussel. *Cotylaspis* was only found in large numbers in areas where *Anodonta* was common and was not collected at all where *Anodonta* was not collected. If this striking affinity for *Anodonta* is real, then it would appear that Manter's assumptions about specificity and zoogeography help to explain in part the differences in abundance and distribution between these two trematodes.

In a study done in Florida by Hendrix and Short (1965) however, *Cotylaspis* was more common than *Aspidogaster*. Their results showed that *Cotylaspis* infested 19 of 31 species of mussels, while *Aspidogaster* infested only 15 species.

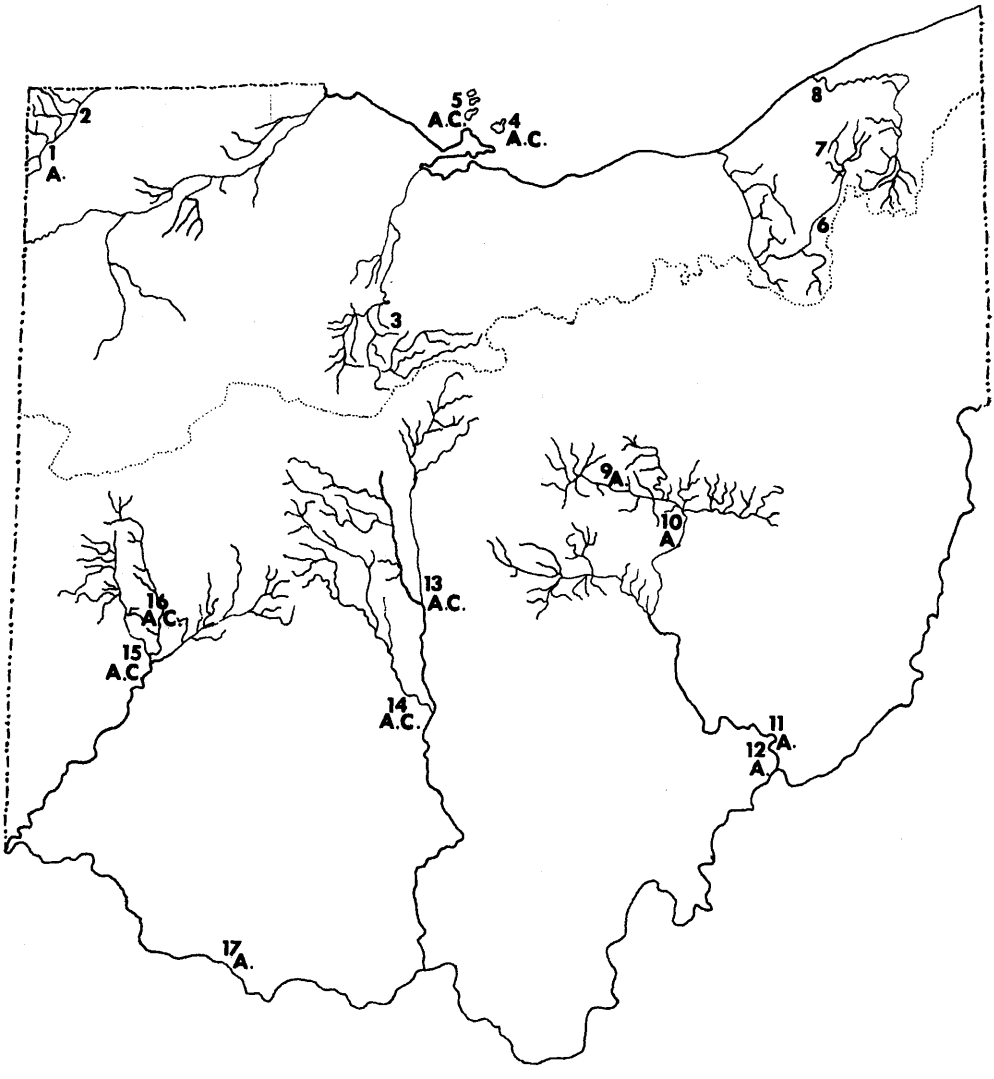

FIGURE 1. Collection localities and distribution of aspidobothreans in Ohio. A. = *Aspidogaster;* C. = *Cotylaspis*. Numbers correspond to the localities in Table 6.

It is reasonable to assume that *Cotylaspis* has a wider distribution and is more abundant than *Aspidogaster* in Florida partly because it has a relatively lower host specificity in that area. The fundamental question which remains unanswered, however, is why is the host specificity of *Cotylaspis insignis* high in Ohio and lower in Florida? Further studies of the life history, behavior, and ecology of these organisms are necessary before this question can be answered, studies which should reveal valuable information about this host-parasite relationship, and about the specificity of parasites in general.

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